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ABSTRACT

Data on the development of fundamental frequency patterns and the emergence of semantic relations during the "one word period" in child language development are reported in this study. The research focuses on the changes that occur as children progress from producing single words to sequences of single words and finally to producing two-word utterances. Four children were audio and video tape-recorded once every two weeks for 30 minutes until they began to produce primarily two-word utterances. All utterances were examined spectrographically to determine the characteristics of fundamental frequency and duration. The study presents data in tabular and graph form collected from one male subject, spanning the ages of 19 to 22 1/2 months, over seven sessions. Generally, the proportion of sequences and two-word utterances to single-word utterances increased over the observational sessions. The findings suggest that sequences of single words were planned as a linguistic unit, since they share fundamental frequency characteristics with unified two-word utterances, despite the fact that a pause had intervened between two words during execution. It is concluded that sequences of single words appear to be structured units that reflect the transition between single words and multiple-word utterances. (EJS)

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SEQUENCES OF SINGLE WORDS AS STRUCTURED UNITS[1]

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Until recently psycholinguists have not engaged in detailed studies of the language development of children during the one word stage. This period was neglected for a number of reasons. First, there was a tacit assumption that the one word stage was a period of lexical expansion and phonological categorization alone. Second, the holophrastic description of single word utterances persisted and primary interest was focused on writing grammars for child language. This endeavor required utterances longer than a single word. The current interest in the one word stage appears to be the result of a search for a cognitive or pragmatic base for language development. Further, these interests coincide with challenges to the position that syntax plays a basic role in language acquisition.

The prevailing view is that a child's first productive two word utterances express semantic notions arising from a child's prior conceptualizations about the relations among people, objects, and events in the environment. Whether or not children intend to express single aspects of semantic relations during the one word period is, at present, undetermined, although arguments have been advanced on both sides of the issue.

One question that has been addressed is the nature of the constraints which prevent the production of unified, two word utterances. On the one hand, Bloom (1973) views the limitation to single word utterances as a cognitive limitation which constrains the number of semantically related items that can be expressed in a single utterance. On the other, Greenfield and Smith (1976) propose that there is some, "...physical limitation to the number of words said on one topic" (p. 193).

At any stage of development, one's claims about a child's linguistic knowledge must be justified by the data since inferences based solely on adult access to the situation and adult interpretation of intentions can be misleading. During the one word stage, this problem is particularly acute since there is little data on which to base inferences about what the child knows about the structure of his language. As Bloom has adequately demonstrated, however, the one word

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period of development does exhibit developmental changes. That is, this period is not exhaustively characterized by the sole phenomenon of producing single word utterances. By describing these changes, in detail, we can expand the base of evidence on which to make informed judgments about a child's emerging linguistic knowledge.

Many researchers (Buhler, 1922; Jesperson, 1922; Stern, 1924; Bloom, 1973; McNeill, 1974; Scollon, 1974; Greenfield and Smith, 1976) have identified a phenomenon during the second half of the one word stage which is characterized by the production of sequences of single words. These utterances are produced at a time when the child is still producing many one word utterances and occasional two word utterances. These sequences, called successive single word utterances by Bloom and vertical constructions by Scollon, are generally characterized by a distinct pause between the two words. Further, both words appear to refer to a single contextual situation or topic. Bloom distinguishes them further as having relatively equal stress and unmistakable terminal pitch contour on each word. Scollon also describes these sequences as, "...not linked by intonation pattern..." (p. 70).

The focus of our study is the changes which occur over the one word period as children progress from producing single words to sequences of single words and finally to producing two word utterances. In particular, our ongoing investigation of the development of these utterance forms reveals the following features:

i) words uttered in a sequence, although separated by a pause, share intonation characteristics with unified two word utterances but not with isolated single words.

ii) the fundamental frequency patterns of single words, sequences of single words and two word utterances undergo developmental changes prior to the predominant production of two word utterances.

iii) there are significant differences between the durational characteristics of words in isolated single word utterances and the non-final words in sequences and two word combinations.

iv) semantic relations are first coded in sequential, single word form and later as two word utterances.

This paper will report data on the development of fundamental frequency patterns and the emergence of semantic relations.

Method

Children were audio and video tape recorded over the one word period. All utterances were examined spectrographically to determine the characteristics of fundamental frequency and duration. Measurements of the fundamental frequency patterns were made at the 5th harmonic on narrow band spectrograms. Sequential single word utterances and two word utterances were distinguished by the length of the pause which intervened between the two words. Utterances which contained a pause between 400 and 1100 milliseconds were categorized as

sequential single word utterances. Utterances which contained a pause of less than 400 milliseconds were classified as two word utterances. These categories are based on an independent investigation (Stokes and Branigan, in preparation) of adult perception of two word sequences. A pilot study revealed that adults categorically judge a two word sequence to be two separate words when the intervening pause reaches 400 milliseconds. Possible semantic relations in sequences of single words and two word utterances were determined from both linguistic and contextual cues. The subjects were recorded once every two weeks for 30 minutes until they began to produce primarily two word utterances. Each child was provided with toys, books, and other items and taping began when the subjects appeared to become accustomed to the setting. There are four children in our study, three boys and one girl. The data reported here are from our first subject, David, for whom we have complete data. David first entered the study at 19 months and continued over seven sessions until 22 and one half months.

Results

During the time David was seen, the total number of utterances varied from session to session, but generally the proportion of sequences and two word utterances to single word utterances increased over the observational sessions.

An analysis of the fundamental frequency contours of isolated one word utterances at each session provided baseline data for normal intonation patterns. Specifically, we were interested in establishing the normal level of the fundamental frequency at the terminal point for single words. It was reasoned that if each word in a sequence of single words ended with a terminal contour as suggested in the literature, then the fundamental frequency contour for each word in a sequence would not differ significantly from the contour established for isolated, single words. This finding would be consistent with the claim that each of the words in such sequences was independently planned and executed and that no semantic relation between the words should be inferred. However, a fundamental frequency pattern which exhibited a terminal contour only at the end of the final word in a sequence of single words would suggest the need for an alternative description of the structural characteristics of these utterances types.[2]

The analysis of fundamental frequency patterns excluded utterances with rising contours. This was done for two reasons. First, an equal distribution of rising and falling contours on the first word in a sequence, when averaged, would produce an artifact. That is, one would find a mean value at the offset of the first word which appeared level

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[2] Fongay (1972) reports findings that concur with this hypothesis. For his Hungarian subject, the intonation contour did not fall to a terminal level at the end of the first word in a sequence of single words. This work was pointed out to me by David Ingram after the presentation of this paper, and regrettably, does not receive sufficient discussion here.

when, in fact, all the sample points were either above or below that point. Second, we are focusing on declarative utterances to test the claim in the literature that, "Each word ended with a terminal falling pitch contour..." (Bloom, 1973). In this regard, utterances with rising contour do not contribute relevant evidence, for or against, this assertion. Nonetheless, over the seven sessions, there were only 15 sequences of single words with a rising contour on the first word.

Over the observational sessions, we found both static and changing features of the overall fundamental frequency patterns. The terminal level of the contour at the end of an utterance was a stable aspect while the level of onset at the initiation of an utterance and the degree of rise of the fundamental at a syllable peak were changing features.

At each session, regardless of the variations in the fundamental frequency level at onset and at the syllable peak, isolated single word utterances exhibited a consistent terminal point at approximately 180 cps. Table 1 records the levels of the fundamental frequency pattern at three points--onset, syllable peak, and offset--for all utterance types over the sessions. The pattern for isolated single words has been repeated for convenience of comparison to the pattern on final words in sequences and two word utterances.

Table 1

		Mean values of F_0 at onset, peak and offset						
		Onset	Peak	Offset	Onset	Peak	Offset	
Sess 1	isolation	254	310	181	(254)	(310)	(181)	n=20
	sequences	250	260	210	240	245	175	n= 4
	two words	-	-	-	-	-	-	
Sess 2	isolation	345	417	196	(345)	(417)	(196)	n=44
	sequences	352	362	257	307	477	192	n= 8
	two words	-	-	-	-	-	-	
Sess 3	isolation	292	414	181	(292)	(414)	(181)	n=23
	sequences	340	426	240	253	353	193	n= 3
	two words	348	384	236	240	320	172	n= 5
Sess 4	isolation	270	323	180	(270)	(323)	(180)	n=18
	sequences	249	280	212	249	260	161	n=11
	two words	244	256	208	208	208	168	n= 5
Sess 5	isolation	267	293	189	(267)	(293)	(189)	n=25
	sequences	301	353	241	245	279	178	n=32
	two words	280	330	256	228	260	186	n=27
Sess 6	isolation	235	275	183	(235)	(275)	(183)	n=27
	sequences	253	267	232	222	231	162	n=20
	two words	261	273	251	229	233	166	n=16
Sess 7	isolation	238	258	166	(238)	(258)	(166)	n=10
	sequences	293	323	255	245	261	193	n=12
	two words	272	300	270	250	288	182	n=10

As one can see from Table 1, the level of the fundamental frequency at the end of the first word in a sequence of single words did not fall to the normal terminal level found in isolated single words. However, the terminal level of the fundamental frequency pattern on the final word did exhibit normal terminal contour. Further, when one compares the overall patterns for sequences of single words with the pattern exhibited by unified two word utterances, one finds that the two patterns are highly similar (see figures 1a-1g). That is, there is a generally falling contour over the whole utterance in both sequences of single words and in two word utterances and a distinctly terminal contour only at the end of the second word. Similarly, the level of the fundamental frequency at the onset of the second word is generally below the level at the initiation of the first word. Moreover, during those sessions where the overall pattern is not subject to inflated onset and higher levels at the syllable peak, there is no statistically significant difference between the frequency levels at offset of the first word and the onset of the second word despite the intervention of the pause characteristic of sequences of single words.

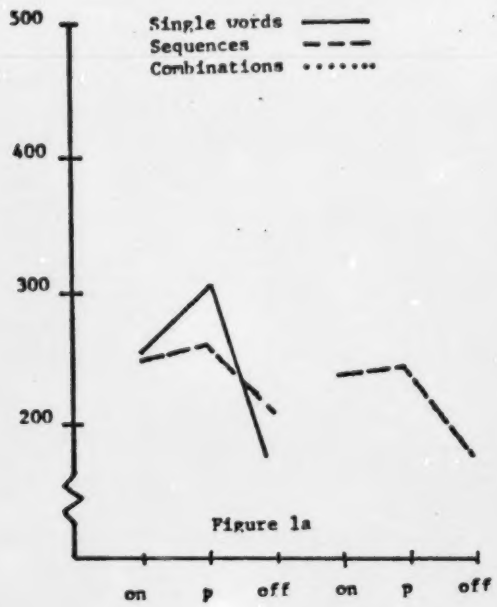

Figure 1a

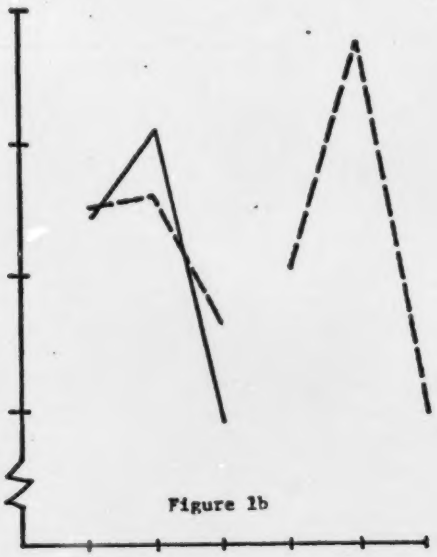

Figure 1b

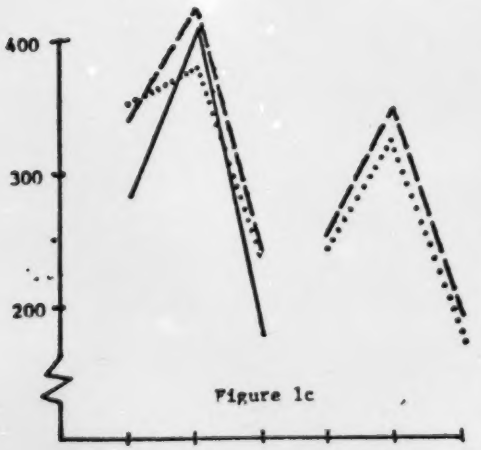

Figure 1c

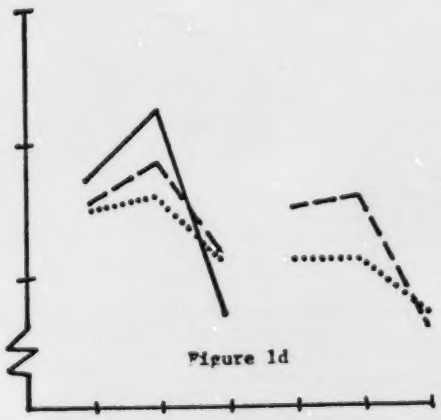

Figure 1d

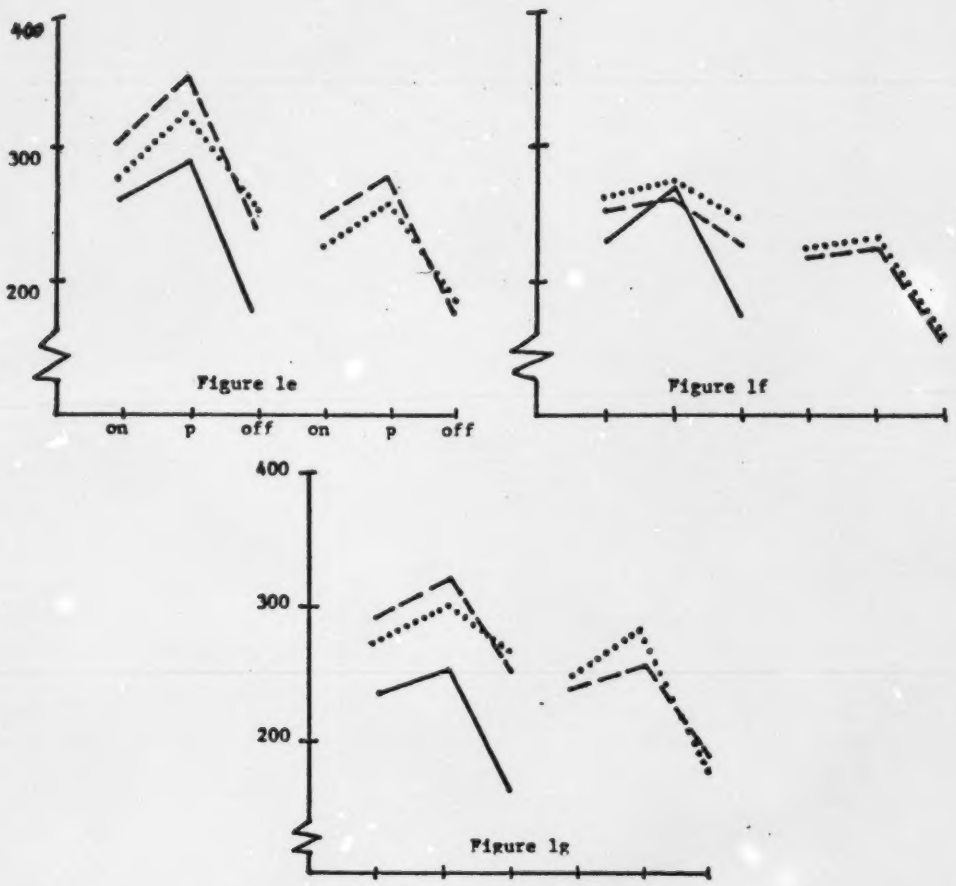

Figure 1e

Figure 1f

Figure 1g

At sessions 2 and 4, there are significant differences in frequency levels between the two words (across the pause), although the end of the first word still does not exhibit normal terminal contour. These differences occur simultaneously with changes in two aspects of the overall pattern. At session 2, normal onset has increased by about 100 cps. (compared to session 1) for all utterances. For single word utterances, the contour either rises sharply to a level at least 80 cps. higher than the level at onset or increases moderately at the syllable peak and then, in both cases, falls to a terminal level. For sequences of single words, the first word has a flat transition from onset to syllable peak and the second word exhibits a sharp rise at the syllable peak and then a fall to a terminal level.

Although data are limited at the third session, sequences of single words and two word utterances display a frequency pattern with a sharp rise at the syllable peak of both words and a terminal contour only at the end of the final word. During the fourth session, there is an additional change in the overall patterns which distorts the mean values (reported in Table 1) at offset of the first word and onset of the second word. The three patterns found at this period are:

1) a category with inflated onset and a sharp rise to the syllable peak on the first word and a moderate transition

to the syllable peak and terminal contour at the end of the second word.

2) a category with normalized onset, no sharp rise at the syllable peak on either word and a terminal contour at the end of the second word.

3) a category with depressed onset, no sharp rise at the syllable peak on either word and a terminal contour at the end of the second word.

Despite the variations in level of onset and rise at the syllable peak, the terminal level for all categories was generally depressed (160 cps.) compared to other periods and always lower than the level of offset of the first word.

Two word utterances during this session exhibit a fundamental frequency pattern similar to category 2 for sequences of single words. There is a normalized onset, no sharp rise at the syllable peak on either word and a terminal contour only on the final word.

At the fifth session, the patterns for sequences and two word utterances stabilize into two categories (see Figure 2). The first category is characterized by: a) normal onset, b) no sharp rise in contour at the syllable peak for either word, and c) a terminal contour at the end of the second word. The second category is characterized by: a) a higher level of fundamental frequency at onset, b) a sharp rise in the contour at the syllable peak only on the first word and c) a terminal contour at the end of the second word.

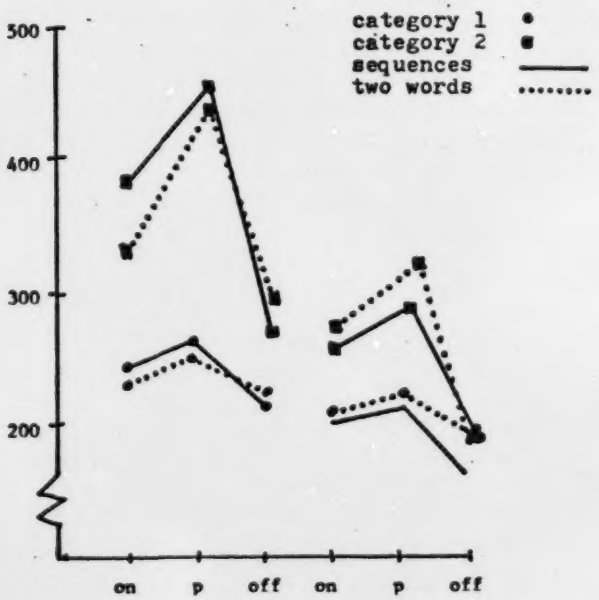

Figure 2

The pattern of the fundamental across the boundary is the same for both categories (no significant differences between offset and onset) and both categories exhibit terminal contours only on the final words. In contrast to isolated single words, the contour at the end of the first word in sequences and two word utterances is not a terminal contour and the level of the fundamental at the onset of the second word is lower than the level normally found at the initiation of an utterance. These characteristics are remarkably similar to the pattern reported in Lieberman (1967) for the intonation contour across pauses in adult speech.

During the 5th and increasingly into the 6th and 7th sessions, sequences of single words become longer. We now find sets of utterances which are: a) sequences of single words three or four words long, b) combinations of two word utterances preceded or followed by a single word, c) two word utterances sequentially followed by another two word utterance and d) a few four word utterances. The striking feature of the fundamental frequency patterns, regardless of the composition or the length of the set, is that one finds a terminal contour only on the final word.

Discussion

These findings suggest that words in a sequence are not independently planned single words whose only relation is their common contextual reference. Rather, they suggest that sequences of single words were planned as a linguistic unit, since they share fundamental frequency characteristics with unified two word utterances, despite the fact that a pause has intervened between the two words during execution. This linguistic relation between the two words in a sequence provides motivation for postulating that children do intend to express semantic relations in uttering sequences of single words.

If we supply the semantic relations justified by the lexical content and the situational context, an interesting pattern emerges over development. During each session, we find some exemplars of the relations existence, non-existence, possessor-possessed, locative and aspects of the agent-action-object relations coded in sequences of single words. At the first and second sessions, there are only three two word utterances and they encode the relations of existence and possessor-possessed. During the third session, the categories of possessor-possessed and object-location appear as two word utterances approximately one third of the time and are encoded as sequences two thirds of the time. However, aspects of the agent-action-object relations, although appearing in sequential form, are not coded as two word utterances during the first four periods. During the 5th and 6th periods, the relations existence, non-existence and (now) recurrence are coded as two word utterances two thirds of the time. Possessor-possessed and locatives are coded as two

word utterances fifty percent of the time and aspects of the agent-action-object relation are coded as two words in only one third of the utterances. This pattern over development suggests that semantic relations are first encoded as sequences of single words and then later as two word utterances.

Conclusions

The issues which arise as a consequence of these findings are provocative. If sequences of single words are unitary constructions as we suggest, then any attempts to use MLU as a developmental criterion over this period is misleading under the usual conditions of defining 'utterance'. Words which appear in these sequences should not be counted as single words since they seem to form a construction, yet they are not quite two word utterances since the pause disrupts their fluent execution.

Second, these findings further erode the foundation on which a stage interpretation of development is based. These data suggest that the closer one investigates specific linguistic features necessary to the production of fluent, multiple word utterances, the more continuous development will appear.

Third, the nature of the constraints which prevent children from producing fluent two word utterances must be examined more fully. In addition to some necessary prerequisite level of cognitive development, there may also be general organizational and specific linguistic constraints which inhibit the production of two word utterances even though the intention to do so is present.

Fluent multiple word utterances require the acquisition and controlled use of many factors. These factors include at least duration, stress assignment, intonation contour and appropriate word ordering. Once the child begins to acquire these factors, they must be organized and simultaneously controlled in order for fluent multiple word utterances to be produced. It is our contention that these parameters are first acquired and controlled on the smallest domain to which they apply. As attempts are made to integrate additional parameters or extend controlled features to larger domains, a child may temporarily produce utterances like sequences of single words which reflect his inability to control all of the relevant linguistic features. For example, in our data, the fundamental frequency patterns which exhibited a sharp rise at the syllable peak in contrast to the flat patterns, with moderate rise to the syllable peak, were first evident on single words. After some development, these patterns were then distinguished and applied to sequences of single words and finally to two word utterances. As this pattern was first being applied to sequences of single words, previously stable intonation patterns were disrupted and altered until the new patterns became organized into a system extending over more than one word. This same pattern of development appears to be repeated once again at the sixth session as the longer sets of utterances emerge.

Essentially our position is this: After children have achieved the necessary cognitive prerequisites to encode multiple aspects of existing relations, they must still acquire and organize many supra-segmental features which characterize fluent adult utterances into an integrated system. They do this by applying these features to progressively larger domains. Further, any lag between the acquisition of a linguistic feature and full control of that feature will result in productions like sequences of single words. The unique aspect of these utterances is that on one level (here, fundamental frequency) they appear to be structured units, but on another level (the pause between the words) exhibit less than full integration and control.

A more complete analysis of the organizational constraints limiting children to producing only some aspects of entire linguistic domains is in preparation. However, as it now stands, sequences of single words appear to be structured units which reflect the transition between single words and multiple word utterances. Further, this period is of significant theoretical importance. It is from transitional periods such as these that we observe changes in state and therefore can examine the processes involved in the evolution of linguistic knowledge.

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